

Project Number: T-108-R-1

Project Title: Distribution, Abundance, and Recruitment of Amphibian SGNC in the Vermilion River Conservation Opportunity Area

1. NEED

Approximately 220 million acres of wetlands are estimated to have existed in the continental U.S. prior to 1700 (U.S. EPA 2003), but more than 90% of these wetland habitats have since been degraded, drained, or altered for other uses (Dahl 1990). While losses of wetland habitat have been curtailed, more than 60,000 acres of wetlands are lost each year (U.S. EPA 2004, Dahl 2011). To preserve the remaining wetlands, the U.S. Clean Water Act mandates that the physical, chemical, and biological integrity of wetlands be protected. Despite the attention given to the “no net loss” of wetland area (quantity), much less attention has focused on the ecological integrity (quality) of wetlands even though the actual ecological success (as opposed to regulatory success) of a wetland protection program requires measurable ecological performance goals as opposed to measuring acres of wetlands restored (NAS 2001, Mack 2007). While wetland loss rates are declining, the trends are deceiving from an ecological perspective as natural wetlands are being replaced with open water ponds with drastically different biological and hydrological functions (Dahl 2011).

In Illinois, wetland conversion and drainage has matched or exceeded national trends, with an estimated 90% of original wetland area being lost (Suloway and Hubbell 1994). Due to the extensive loss of wetland habitats throughout Illinois, assessment and protection of wetlands is a high priority within the state (IDNR 2005). Action Item 2 of the Wetlands Campaign in the Illinois Wildlife Action Plan is to develop and manage additional wetland habitat by recreating ephemeral and other fishless, semi-permanent wetlands (IDNR 2005). Further, Action Item 3 is to fill information gaps and develop conservation actions to address remaining wetlands in Illinois. Specifically, the action item calls for: 1) research on the ecological aspects of high-quality wetland sites; and 2) assessment of the status and distribution of wetland-dependent amphibians.

Amphibians make up critical ecological components of many wetland ecosystems where they play a prominent role in food webs as both predators of invertebrates and prey of larger vertebrates (Davic and Welsh 2004), and they often exceed the combined biomass of other terrestrial vertebrates within the system (Burton and Likens 1975, Peterman et al. 2008). Wetland loss currently threatens 32 of the 41 amphibians in Illinois that are dependent upon wetlands for reproduction (Phillips et al. 1999, U.S. EPA 2003). Statewide there is concern about apparent local amphibian extinction and widespread decreases in their abundance (IDNR 2005 – III.F).

Of particular concern from a management perspective is the fact that habitat creation (i.e. wetland creation/mitigation) can create ecological traps (Schlaepfer et al. 2002, Battin 2004). Generally defined, ecological traps occur when organisms choose to utilize habitats of poor quality. For amphibians, the aquatic environment can directly influence time and size at metamorphosis (Semlitsch and Wilbur 1988, Scott 1994), as well as affect survival rate (Scott et al. 2007). Further, carryover effects from conditions experienced in the aquatic environment can significantly influence growth in the terrestrial environment (Allen et al. 2010). Thus, from an amphibian perspective, use of poor quality habitat may result in reduced number of offspring,

reduced quality of offspring, or reduced survival in the terrestrial environment. Any or all of these outcomes has the potential to seriously jeopardize the long term persistence of amphibians on the landscape (Harper et al. 2008). As such, a clear understanding of wetland function is critical to managing for the long-term persistence of species on the landscape. Clearly, simple documentation of species presence is far from adequate when assessing wetland function for amphibians.

Most amphibian sampling in Illinois is opportunistic, so there is a poor understanding of their distributions and abundances (IDNR 2005-III.F). This critical information gap highlights the need to implement monitoring and research programs that will aid in the identification of conservation needs (IDNR 2005 - III.C. & III.E.). Because recruitment rates of amphibians into the adult population are not well understood (but thought to be low for many species; IDNR 2005 - III.D), surveys and monitoring of their reproductive success will be an integral part of identifying conservation needs.

As part of the Wetlands campaign, more than twenty semi-permanent wetlands have been created in the Vermilion River Conservation Opportunity Area (VRCOA) of Illinois (Roger Jansen, IDNR DHB *pers. comm.*). These wetlands have the potential to provide breeding habitat for three amphibian species in greatest need of conservation (Silvery Salamander [*Ambystoma platineum*], Four-Toed Salamander [*Hemidactylium scutatum*], and Wood Frog [*Lithobates sylvaticus*]). Both the Silvery Salamander and Four-Toed Salamander are afforded protection under the Illinois Endangered Species Act as state endangered and state threatened, respectively, while the Wood Frog is considered a species of special concern in Illinois (IDNR 2005, Mankowski 2012, Mankowski 2014). All three species are considered rare, occurring in low population sizes and densities, in a restricted range and are believed to have significantly declined in abundance and distribution (IDNR 2005). Of additional concern for all three species is their dependence upon rare or vulnerable habitats. Both Silvery Salamanders and Wood frogs utilize small ephemeral wetlands in hardwood forests (Phillips et al 1999) and Four-Toed Salamanders inhabit mature deciduous forests with seeps and springs, and swamps and ponds with ferns and mosses (Minton 2001). All three species are considered a critical resource within the VRCOA (IDNR 2005: IV.M, Appendices I & II) and their current distributions and abundance are unknown. In fact, until recently the Silvery Salamander was known from only one wetland in Illinois. Of late, incidental observations and limited sampling have documented the species from an additional nine wetlands in Vermilion County, IL but nothing is known about the demographics of these populations or if additional populations may exist.

2. PURPOSE AND OBJECTIVES

The purpose of this study is to assess amphibian SGNC populations in the Vermilion River Conservation Opportunity Area. Funds approved through this grant will be used to: 1) survey wetlands to determine the distribution, relative abundance, and recruitment of SGNC amphibians, as well as the characteristics of wetlands that are successfully used by SGNC amphibians within the VRCOA; 2) evaluate the success of recently created wetlands in providing suitable breeding habitats (including an assessment of recruitment success) for SGNC amphibians within the VRCOA; and 3) write and disseminate a final report for this project.

3. EXPECTED RESULTS OR BENEFITS

At the conclusion of this study we will produce a report that includes: 1) the distribution and abundance of three amphibian SGNC from wetlands within the Vermilion River Conservation Opportunity Area; 2) a protocol and baseline data for monitoring amphibian SGNC within the Vermilion COA; 3) information on the demographics and recruitment of the species from both historical reference wetlands as well as those that have been recently created per the IWAP recommendations; and 4) wetland characteristics important to the recruitment of juveniles into adult populations to both guide the creation of additional wetlands, or improve conditions at current wetlands.

4. APPROACH

This project will be completed by staff of the Illinois Natural History Survey, Champaign, IL and National Great Rivers Research and Education Center, East Alton, IL.

Objective 1. Determine distribution, relative abundance, and habitat characteristics of breeding ponds used by SGNC amphibians (to be completed by 12/31/2016).

Job 1a. Identify up to 40 potentially suitable wetlands within the VRCOA to sample for amphibian SGNC. We will utilize our current knowledge of wetlands within the area, coupled with suggestions from IDNR District Heritage Biologists (R. Jansen and E. Smith), Topographic Maps, National Wetlands Inventory data layers, and satellite imagery to identify ponds on private and public (e.g., Middlefork State Fish and Wildlife Area, Kickapoo State Park, Harry “Babe” Woodyard State Habitat Area, Georgetown Addition of the Little Vermilion Land and Water Reserve) properties.

Job 1b. We will sample up to 40 wetlands (both reference and recently created) in the Vermilion River COA for three amphibian SGNC (Wood Frogs, Silvery Salamanders, and Four-toed Salamanders). In each wetland we will conduct 4 rounds of sampling with each round consisting of two sampling nights. Two sampling rounds will occur in the late-winter-early spring during the breeding season, and two nights will occur in early summer directly preceding the emergence of metamorphic amphibians (N=8 total sampling events per wetland). We will sample for SGNC amphibians using dip nets and minnow traps. Number of traps and dip net sweeps will be scaled to the size of the surface area of the wetland to ensure equal sampling effort.

Job 1c. Estimate relative abundance of breeding adults and late stage larvae in up to 40 wetlands. We will estimate abundance and density of each species using hierarchical N-mixture models to correct for imperfect detection.

Job 1d. Quantify the relationship between wetland characteristics (wetland slope, hydroperiod, canopy cover, substrate cover, wetland size) to presence, relative abundance and recruitment of SGNC amphibians. This data will be used to develop habitat models by employing regression analyses using an information-theoretic approach (AIC) in program PRESENCE 8.6 or R package ‘unmarked’

Objective 2. Evaluate the success of recently created wetlands in providing suitable breeding habitats for SGNC amphibians within the VRCOA (to be completed by 12/31/2018).

Job 2a. Construct drift fences at two recently created wetlands and two reference wetlands to determine use and recruitment out of the wetlands. Fences will be constructed of aluminum flashing and will completely encircle each of the four wetlands. Pitfall traps (19L buckets) will be placed every 5 meters along the interior and exterior of the fence and be buried with their openings flush with the substrate surface. Moist sponges will be placed in the buckets during active trapping periods to prevent desiccation of captured animals and the traps will be checked at least once every 48 hours.

Job 2b. Quantify key demographic parameters (sex ratio, body size, body condition of adults and juveniles) at the fenced wetlands. All individuals entering and leaving the wetlands will be identified to species and sex. We will record length and weight of all amphibian SGNC captured to assess body condition. Significant differences in any of these metrics may indicate critical differences between created and reference sites in terms of wetland function for amphibian SGNC.

Job 2c. Determine how climatic and landscape variables affect pond use, recruitment, and productivity. In addition to the habitat metrics collected in Job 1c above, we will place iButton data loggers ($\pm 1^\circ\text{C}$ accuracy) in each of the fenced ponds to continuously monitor water temperatures. This data will be used in regression analyses to determine factors most affecting differences between created and reference wetlands in terms of SGNC reproductive potential and recruitment.

Job 2d. Determine if recently constructed wetlands are functioning to the benefit of amphibian SGNC. Because our study will intensively monitor the same wetlands over two seasons, we will be able to make initial assessments of the role of temperature, precipitation periodicity, precipitation amount, and hydrology on amphibian reproductive effort, success, growth and survival.

Objective 3. Finalize project

Job 3a. Prepare a report with recommendations on the management of VRCOA lands for amphibian SGNC.

5. USEFUL LIFE

The grant funds supporting this project will not be used to purchase equipment or for capital improvements; therefore the calculation of a useful life for the grant is not possible or applicable.

6. GEOGRAPHIC LOCATION

This study will occur within the Vermilion River (Middle Fork, North Fork, & Salt Fork) and Little Vermilion River Conservation Opportunity Area located within the Grand Prairie and Wabash Border Natural Divisions of Illinois (Appendix A). This area encompasses 791,655 acres including major portions of Champaign and Vermilion Counties along with portions of Ford, Iroquois, and Edgar Counties, Illinois. The majority of ponds sampled will come from

Middlefork State Fish and Wildlife Area, Kickapoo State Recreation Area, and Harry “Babe” Woodyard State Natural Area.

7. PRINCIPAL INVESTIGATORS

Andrew R. Kuhns — Project Manager
Illinois Natural History Survey
Prairie Research Institute
University of Illinois
1816 South Oak St.
Champaign, IL 61820
217.265.6707
arkuhns@illinois.edu

Christopher A. Phillips
Illinois Natural History Survey
217.244.7077

John A. Crawford
National Great Rivers Research and Education Center
One Confluence Way, East Alton, IL 62024
618.468.2838

William E. Peterman
Illinois Natural History Survey
217.244.8191

8. PROGRAM INCOME

No program income will be generated as a result of this grant.

9. BUDGET NARRATIVE

Project Title: Distribution, abundance, and recruitment of amphibian SGNC from the Vermilion River Conservation Opportunity Area

Project Number: T-108-R-1

Project Time Frame: Start Date - 10/01/2015; End Date - 12/31/2018

Project Budget

Expense Line Item	Request	Match	Total
SALARIES & WAGES			
Professional	\$0	\$7,374	\$7,374
Non-student hourly	\$29,760	\$0	\$29,760
Total Salaries & Wages	\$29,760	\$7,374	\$37,134
FRINGE BENEFITS			
Professional @ 39.14%	\$0	\$2,886	\$2,886
Non-student hourly @ 7.80%	\$2,321	\$0	\$2,321
Total Fringe Benefits	\$2,321	\$2,886	\$5,207
Total Salaries, Wages, & Fringe Benefits	\$32,081	\$10,260	\$42,341
TRAVEL			
Operation of Auto (in state)	\$25,675	\$0	\$25,675
Total Travel	\$25,675	\$0	\$25,675
MATERIALS & SUPPLIES – General			
Aluminum flashing (36"x50' @ \$130 ea.)			
N =25	\$3,250	\$0	\$3,250
fencing stakes (25/pk @ 35.50ea, n=10)	\$355	\$0	\$356
ibuttons (\$23 ea, n=40)	\$920	\$0	\$920
screws/ washers	\$60	\$0	\$60
minnow traps (25 @ 8 ea)	\$200	\$0	\$200
waterproofing dip	\$5	\$0	\$5
Total Materials & Supplies	\$4,790	\$0	\$4,790
Total Direct Costs	\$62,546	\$10,260	\$72,806
Modified Total Direct Costs (MTDC)*	\$62,546	\$10,260	\$72,806
F&A (20% of MTDC)	\$12,509		\$12,509
F&A (58.6% MTDC)		\$6,012	\$6,012
Unrecovered F&A (20% vs. 58.6%)		\$24,143	\$24,143
Total Proposed Project Budget	\$75,056	\$40,415	\$115,471
	65%	35%	100.0%

Budget Justification

Salaries and Wages: We request wages to hire one seasonal full-time hourly technician at a rate of \$12.00/hr. for 62 weeks over the duration of the project. The technician will be necessary to assist with field work in checking the pond fences daily and monitoring ingress and egress of amphibians at the ponds. Match will be provided in the form of **5.0485%** of the salary for PI Andrew Kuhns.

Fringe Benefits: We request \$2,321 in fringe benefits calculated at a rate of 7.8% of wages for the hourly technician. Match in the form of fringe for A.R. Kuhns' salary is calculated at the rate of 39.14%.

Travel: We request \$25,675 for in state travel. This figure includes: mileage between Champaign, IL and the study sites in **an INHS fleet vehicle** at a rate of \$0.54/mi (350 trips of 120 mi.); trips for one PI and a technician to **travel in an NGREEC fleet vehicle from Alton, IL to Champaign, IL** at \$0.40/mi (12 trips @ 400 mi.). **INHS and NGREEC amortize their fleet vehicles differently; thus per mileage costs differ. We also request funds for the use of a John Deere Gator ORV. The Gator is an INHS fleet vehicle that was not purchased with federal funds. Since it does not have an odometer the cost is calculated per day in the field. The daily rate is \$43. We will use the Gator for 25 days for this project.**

Equipment: NA

Materials and Supplies: The \$4,790 in supplies will be used to purchase: 1) fencing supplies including: aluminum flashing (36" x 50' @ \$130 roll; 25 rolls); wooden stakes (60" x 3/4" @ 35.50 per 25 pack, n=10) and **\$60** for washers and screws to attach stakes to flashing (fencing will be used to encircle four ponds and monitor movements of amphibians between terrestrial and aquatic habitats); 2) Forty iButton dataloggers (\$23/each; **\$920** total) and waterproof coating (\$5.00) to place them at the ponds to record environmental variables; and 3) 25 minnow traps at \$8.00 each to replace traps that may become damaged during the study.

Contractual Services: NA

Other: NA

10. MULTIPURPOSE PROJECTS

This is not a multi-purpose project.

11. RELATIONSHIP WITH OTHER GRANTS

A subset of the ponds proposed for sampling in this project were sampled for U.S. EPA Region 5 Wetland Program Development Grants CD-00E00730 and CD-00E00963. A separate IL SWG being prepared by Matt Allender, "Assessing Wellness in Wildlife Herptile Species in Greatest

Need of Conservation”, T-104-R-1, will take advantage of our sampling to assess the health of Silvery Salamanders we encounter in our traps and drift fences.

12. TIMELINE

	<i>Nov.- Dec. 2015</i>	<i>Feb.- Apr. 2016</i>	<i>May- July 2016</i>	<i>Aug.- Dec. 2016</i>	<i>Feb.- Apr. 2017</i>	<i>May- July 2017</i>	<i>Feb.- Apr. 2018</i>	<i>May- July 2018</i>	<i>Aug.- Dec. 2018</i>
<i>Job 1a.</i>									
<i>Job 1b.</i>									
<i>Job 1c.</i>									
<i>Job 1d.</i>									
<i>Job 2a.</i>									
<i>Job 2b.</i>									
<i>Job 2c.</i>									
<i>Job 2d.</i>									
<i>Job 3.</i>									

13. GENERAL

(i) **Substantial in Character and Design**

The project statement describes a need consistent with the State Wildlife Grants (SWG); states a purpose and sets objectives, both of which are based on the need; uses a planned approach, appropriate procedures, and accepted principles of fish and wildlife conservation and management, and research and is cost effective

(ii) **Compliance**

The IDNR will use its CERP (Comprehensive Environmental Review Process) as a tool to aid the Department in meeting NEPA compliance for the project outlined under this grant proposal. It is the Department's policy to require CERP applications for all land disturbing activities unless those activities are covered by CERP exemptions.

All planned activities will also be in compliance with the Endangered Species Act. All determinations and documentation will be in accordance with the current established U.S. Fish and Wildlife Service protocols for section 7.

All planned activities will be in compliance with the National Historic Preservation Act and the Council on Historic Preservation Act. All determinations and documentation will be in accordance with the terms of the Programmatic Agreement, as amended, effective September 23, 2002.

When applicable, those planned activities which involve a floodplain and/or jurisdiction wetlands will be done in accordance with Presidential Executive Orders 11988 and 11990.

When applicable, those planned activities which involve programs and/or site improvements will be done in accordance with Section 504 of the Rehabilitation Act and the Americans with Disabilities Act.

When applicable, those planned activities which involve the use of pesticides, herbicides or other comparable chemicals will be done in accordance with current state and federal regulations to assure the safe and legal application of those chemicals. All chemicals will be applied in accordance with the manufacturers label instructions. All persons applying chemicals will be licensed by the Illinois Department of Agriculture as a chemical operator along with a licensed applicator, in accordance with Illinois state law.

APPENDIX A. SUPPLEMENTAL DOCUMENTS

Literature Cited

- Allen, B. G., V. S. Briggs, M. W. McCoy, and J. R. Vonesh. 2010. Carry-over effects of the larval environment on post-metamorphic performance in two hylid frogs. *Oecologia* **164**:891–898.
- Battin, J. 2004. When Good Animals Love Bad Habitats: Ecological Traps and the Conservation of Animal Populations. *Conservation Biology* **18**:1482–1491.
- Burton, T. M. and G. E. Likens. 1975. Salamander populations and biomass in the Hubbard Brook Experimental Forest, New Hampshire. *Copeia* **1975**:541–546.
- Dahl, T. E. 1990. Wetlands losses in the United States 1780's to 1980's. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. Jamestown, ND: Northern Prairie Wildlife Research Center Online.
<http://www.npwrc.usgs.gov/resource/wetlands/wetloss/index.htm>.
- Dahl, T. E. 2011. Status and trends of wetlands in the conterminous United States 2004 to 2009. U.S. Dept. of the Interior; Fish and Wildlife Service, Washington, D.C. 108 pp.
- Davic, R. D. and H. H. Welsh. 2004. On the ecological roles of salamanders. *Annual Review of Ecology, Evolution and Systematics* **35**:405–434.
- Harper, E. B., T. A. G. Rittenhouse, and R. D. Semlitsch. 2008. Demographic consequences of terrestrial habitat loss for pool-breeding amphibians: Predicting extinction risks associated with inadequate size of buffer zones. *Conservation Biology* **22**:1205–1215.
- IDNR. 2005. Illinois Wildlife Action Plan. Accessed at
<http://dnr.state.il.us/orc/wildliferesources/theplan/>.
- Mack, J. J. 2007. Developing a wetland IBI with statewide application after multiple testing iterations. *Ecological Indicators* **7**:864–881.
- Mankowski, A., editor. 2010. Endangered and Threatened Species of Illinois: Status and Distribution, Volume 4 - 2009 and 2010 Changes to the Illinois List of Endangered and Threatened Species. Illinois Endangered Species Protection Board, Springfield, Illinois. iii + 38 pp.
- Mankowski, A. 2012. The Illinois Endangered Species Protection Act at Forty: a review of the Act's provisions and the Illinois List of Endangered and Threatened Species. Illinois Endangered Species Protection Board, Springfield, Illinois. 152 pp. Published online at:
<http://www.dnr.illinois.gov/ESPB/Pages/default.aspx>.

- Minton, S.A. 2001. Amphibians and reptiles of Indiana. Indiana Academy of Science. Indianapolis, IN. p. 404.
- NAS. 2001. Compensating for wetland losses under the Clean Water Act. Committee on Mitigating Wetland Losses, Board on Environmental Studies and Toxicology, Water Science and Technology Board, Division on Earth Life Studies, National Research Council. National Academy Press, Washington, DC.
- Peterman, W. E., J. A. Crawford, and R. D. Semlitsch. 2008. Productivity and significance of headwater streams: population structure and biomass of the black-bellied salamander (*Desmognathus quadramaculatus*). *Freshwater Biology* **53**:347–357.
- Phillips, C. A., R. A. Brandon, and E. O. Moll. 1999. Field Guide to Amphibians and Reptiles of Illinois. Illinois Natural History Manual 8.
- Schlaepfer, M. A., M. C. Runge, and P. W. Sherman. 2002. Ecological and evolutionary traps. *Trends in Ecology & Evolution* **17**:474–480.
- Scott, D., E. Casey, M. Donovan, and T. Lynch. 2007. Amphibian lipid levels at metamorphosis correlate to post-metamorphic terrestrial survival. *Oecologia* **153**:521–532.
- Scott, D. E. 1994. The effect of larval density on adult demographic traits in *Ambystoma opacum*. *Ecology* **75**:1383–1396.
- Semlitsch, R. D. and H. M. Wilbur. 1988. Effects of pond drying time on metamorphosis and survival in the salamander *Ambystoma talpoideum*. *Copeia* **1988**:978–983.
- Suloway, L. and M. Hubbell. 1994. Wetland resources of Illinois: an analysis and atlas. Illinois Natural History Survey Special Publication **15**:1–88.
- U.S. EPA. 2003. Protecting wetlands for amphibian and reptile conservation. Office of Water, EPA Fact Sheet 843-F-03-015.
- U.S. EPA. 2004. Wetlands overview. Office of Water, EPA Fact Sheet 843-F-04-011a.

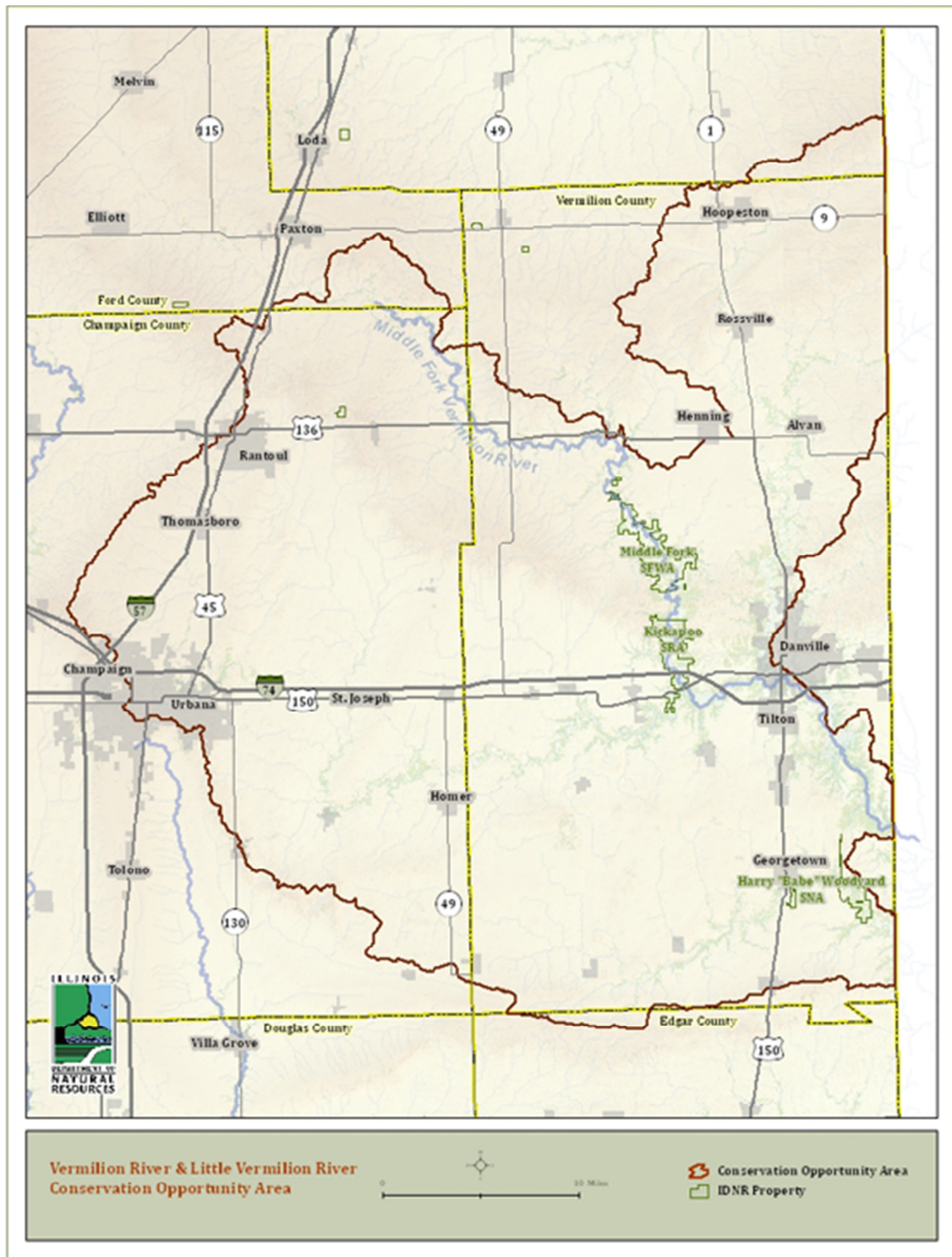


Figure A1. State managed properties within the Vermilion River Conservation Opportunity Area. Map taken from

<http://www.dnr.illinois.gov/conservation/IWAP/Pages/VermilionRiver.aspx>